THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 8. AUGUST 1918.

X.—*On some External Characters of Ruminant Artiodactyla.* —Part II. *The* Antilopinæ, Rupicaprinæ, *and* Caprinæ, *with a Note on the Penis of the* Cephalophinæ *and* Neotraginæ. By R. I. Pocock, F.R.S.

The first part of this series of papers, supplementary to the account of the "Cutaneous Glands of Ruminants" published in 1910 (Proc. Zool. Soc. pp. 840–986), was issued in the Ann. & Mag. Nat. Hist. for June of this year, pp. 426–435. It dealt with the Cephalophinæ, Neotraginæ, Oreotraginæ, and Madoquinæ. The present communication comprises the Antilopinæ, Rupicaprinæ, and Caprinæ, the most interesting forms described being the two Rupicaprine genera *Capricornis* and *Budorcas*, of which I had only defective material for examination in 1910.

As in the previous paper, the pagination inserted after generic and specific names refers to the original treatise published in 1910.

Subfamily *Antilopinæ*.

Genus Gazella, Licht.

In 1910 (P. Z. S. pp. 887–893) I described the preorbital, inguinal, pedal, and carpal or knee-glands in the following species of this genus:—*G. bennettii, subgutturosa, marica, muscatensis, dorcas, pelzelni, cuvieri, rufifrons*, and *sœmmeringii*. My descriptions were based upon fresh examples of all

the species except *G. sœmmeringii*, for which I was dependent upon a dried skin. Since that date I have been able to confirm my observations upon additional and fresh material of *G. bennetti*, *subgutturosa*, *rufifrons*, *dorcas*, *pelzelni*, and *sœmmeringii*, and can now add to the list one previously unexamined species—namely, *G. dama*.

Some notes upon the examples of *G. sœmmeringii* and *G. dama* may be of interest.

Gazella sœmmeringii berberana.—Specimens from Somaliland (*R. E. Drake Brockman*). The preorbital gland is of moderate size or small. The pedal glands are quite normal. The inguinal glands are shallow wide-mouthed pouches external to the mammæ. The carpal glands are thick pads of skin, covered with a mat of convergent hairs.

In a male example the secretion from the inguinal glands smelt like sour milk. In a female the secretion from the same glands, like that from the knees, had a strong ovine scent, like that of a pen of domestic sheep, whereas the waxy secretion from the pedal glands resembled dogs' dung in odour.

The rhinarium (fig. 1, I) is a little less reduced than in typical gazelles, in which it consists of hardly more than a small irregularly pentagonal area of naked skin restricted to the septum between the nostrils (fig. 1, G, H). But in *G. sœmmeringii* its upper edge is slightly expanded and spreads a little to the right and left, partly hanging over the nostrils above.

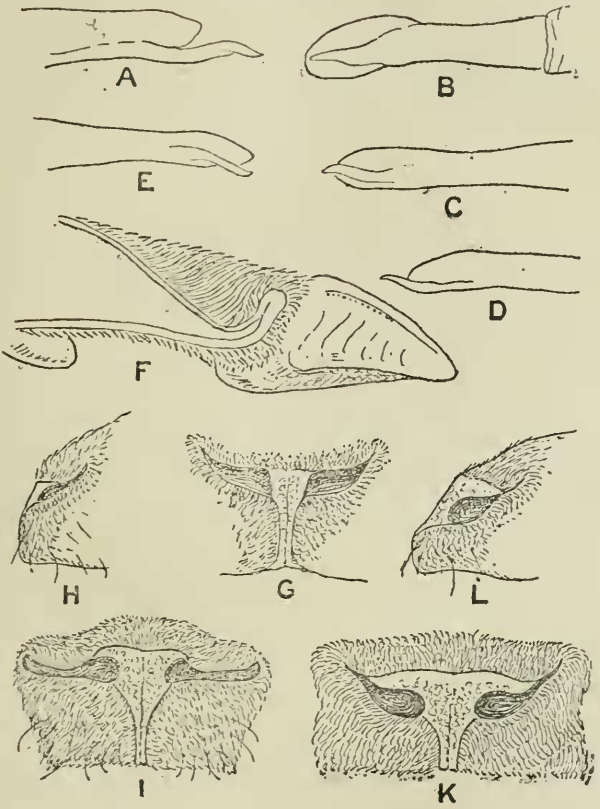
In the penis (fig. 1, B) the tubular prolongation of the urethra is short, barely projecting beyond the tip of the slightly swollen termination of the glans. It is shorter than in ordinary gazelles—e. g., *G. bennettii* (fig. 1, D) and *G. rufina*, figured by Lönnberg in 1904.

Gazella dama ruficollis.—Examples (♂ ♀) from the Soudan (*G. Blaine*). The preorbital gland is a shallow pit, quite small as compared with that of the typical gazelles. The pedal glands are quite normal. The inguinal glands consist of a pair of very shallow wide-mouthed pouches, one on each side just external to the corresponding mamma. The carpal or knee-glands, on the contrary, are rather exceptionally well developed, consisting of a pad of thick skin, overgrown with a mat of mesially convergent hairs covered with scurfy secretion.

The end of the penis in this species is slightly enlarged and the urethra is prolonged as a thin tube a little beyond the tip of the glans (fig. 1, C).

It has been suggested that the three large white-rumped

Fig. 1.



A. Extremity of penis of *Antilope cervicapra.*
B. The same of *Gazella sœmmeringii.*
C. The same of *G. dama.*
D. The same of *G. bennettii.*
E. The same of *Antidorcas marsupialis.*
F. Section of the fore foot of *Lithocranius walleri.*
G. Rhinarium of *Gazella rufifrons* from the front, × $\frac{1}{3}$.
H. The same from the side.
I. The same of *Gazella sœmmeringii* from the front, × $\frac{1}{3}$.
K. The same of *Antilope cervicapra* from the front, × $\frac{1}{3}$.
L. The same from the side.

African gazelles—*G. granti*, *sœmmeringii*, and *dama*—connect the smaller typical African and Asiatic gazelles with the springbuck *Antidorcas*; and Lydekker and Blaine (Cat. Ung. Mamm. iii. p. 85, 1914) adopt for them the subgeneric title *Nanger*, remarking that the group is replaced in South Africa by *Antidorcas*. Although I am only acquainted with the normal pedal glands of *G. granti*, I am unable to find in *G. sœmmeringii* and *G. dama* any justification for the view that they lessen the differences between the typical gazelles and *Antidorcas*, or that they represent the latter in north and east Africa more nearly than the other gazelles of that area represent it.

In the same Catalogue another subgenus of gazelles is admitted under the name *Procapra*, comprising the three central Asiatic gazelles *picticaudata*, *przewalskii*, and *gutturosa*, none of which is known to me apart from dried skins and skulls.

Procapra was established by Hodgson for the reception of *picticaudata*, which, according to his description, differs from other gazelles in having no preorbital, inguinal, or carpal glands; no trace of moist rhinarium, and the interdigital fossæ, described in one place as "pores," small. Moreover, on the positive side it possesses a large postcornual sinus, by which is meant apparently a gland behind the horns analogous to that of *Rupicapra* and *Oreamnos*. Admitting the truth of these observations, and I do not see on what grounds they are to be disputed, *picticaudata* must be recognized as generically distinct from *Gazella*, and *przewalskii*, which at least resembles it in the absence of preorbital, inguinal, and carpal glands, must be associated with it—at all events, provisionally. The species named *gutturosa*, on the other hand, resembles the typical gazelles in having preorbital, carpal, and inguinal glands, the first two being small and the last-mentioned large. Clearly, therefore, it must be severed from *picticaudata* and *przewalskii*, for which the name *Procapra* must be retained. But, according to Pallas, *gutturosa* possesses a preputial glandular sack, recalling that of *Moschus*, *Nototragus*, and *Sus*. In this respect it differs, so far as is known, from all the species of *Gazella*. I propose, therefore, to dismember *gutturosa* from *Gazella* under the generic title *Prodorcas*.

Genus Antidorcas, Sund.

Antidorcas marsupialis, Zimm. (p. 893).

Several fresh examples of this species confirm in every

respect the constancy of the characters established in 1910, showing that, so far as the cutaneous glands are concerned, the genus *Antidorcas* differs from *Gazella* in the absence of inguinal and carpal glands and the presence of the great dorsal gland.

I may add that the rhinarium resembles that of *Gazella* in consisting of a small irregularly pentagonal area on the narial septum, and that the penis is also like that of *Gazella*, the urethral canal projecting a short way beyond the tip of the slightly swollen glans (fig. 1, E).

Genus Antilope, Pall.

Antilope cervicapra, Linn. (p. 894).

My observations upon the cutaneous glands of this antelope were based in 1910 upon two dried skins. Since that date I have seen several fresh specimens, confirming in all respects the characters previously established as distinguishing the genus *Antilope* from *Gazella*. Two other differences are, however, supplied by the rhinarium and the penis. The *rhinarium* (fig. 1, K, L) is considerably better developed, and therefore less specialised than in *Gazella* and *Antidorcas*. Not only is it broader between the nostrils, but it is extended along their upper border nearly as far back as their posterior notch.

In the *penis*, figured by Lönnberg in 1904, the urethral prolongation is longer and thicker than in *Gazella* and *Antidorcas* (fig. 1, A).

Genus Lithocranius, Kohl.

Lithocranius walleri, Brooke (p. 896).

I am indebted to the late Mr. F. C. Selous for the fore and hind feet and the skin of the inguinal area of this species from British East Africa. These show that the foot I examined and described in 1910 was, as suggested, distorted with respect to the glandular interdigital space. This space (fig. 1, F) differs from that of *Gazella*, *Antidorcas*, and *Antilope* in that it gradually deepens from its upper (or proximal) to its lower (or distal) end, where the thick interungual fold curves forward. In other words, the skin of the front of the pastern above the depression passes imperceptibly into the latter by a gradual inclination, without showing a sign of the abrupt descent seen in the other genera. The pedal gland recalls that of *Rupicapra*.

There are two pairs of mammæ, but no inguinal glands.

By their external characters, dealt with in this paper, and by their horns the genera of Antilopinæ here admitted may be briefly diagnosed as follows :—

Genus Gazella, Licht.

Preorbital, inguinal, carpal, and pedal glands present, the pedal glands in the form of long and deep interdigital clefts of even depth throughout ; rhinarium a small irregularly pentagonal moist area on the narial septum, and not, or only to a very small extent, bordering the nostrils above ; urethral canal usually only surpassing the glans penis to a small extent ; horns in males with concavo-convex, usually sigmoid, curvature.

Type, *G. subgutturosa*.

Distribution. From Central and South-western Asia into India and North and East Africa.

Far too many species of this genus appear to me to be admitted by Lydekker in the British Museum Catalogue.

Genus Prodorcas, nov.

Distinguishable from *Gazella* by the presence of a preputial gland and a shorter tail, the structure of the pedal glands being unknown.

Type, *P. gutturosa*, Pall.

Distribution. Mongolia and Northern China.

Genus Antilope, Pallas.

Distinguishable from *Gazella* by the nakedness of the integumental web tying the hoofs together, by the larger rhinarium which borders the nostrils above, by the much longer and thicker elongation of the urethral canal of the glans penis, and by the spirally twisted horns.

Type, *A. cervicapra*.

Distribution. India.

Genus Antidorcas, Sund.

Distinguishable from *Gazella* by the absence of inguinal and carpal glands and by the presence of a large distensible glandular area on the back, which is peculiar to the genus.

Type, *A. marsupialis*, Zimm.

Distribution. Africa south of the Zambesi.

Genus Lithocranius, Kohl.

Distinguishable from *Gazella* by the structure of the pedal glands, the floor of which gradually slopes downwards from the front of the fetlock, the cleft being deepest at its lower end, where it is walled in by the heel-tie; also by the absence of inguinal glands and the presence of four mammæ.

Type, *L. walleri.*

Distribution. British East Africa and Somaliland.

Genus Procapra, Hodgson.

Distinguishable from *Gazella* by the absence of the preorbital, inguinal, and carpal glands, the presence of a gland behind the horns, the reduced size of the pedal glands which apparently have a pore-like orifice, as in *Ovis* and *Nemorhedus*, and, it is stated, by the rhinarium being overgrown with hair.

Type, *P. picticaudata,* Hodgs.

Distribution. Mongolia, China, Tibet.

Subfamily *Rupicaprinæ.*

Genus Rupicapra, Blainv.

Rupicapra rupicapra, Linn. (p. 848).

Several examples of the typical race of this species from the Tyrol have enabled me to verify, and in the case of some characters to extend, my observations, which in 1910 were based upon the carcases of two newly born kids and upon adult specimens living in the Zoological Gardens.

Preorbital and *inguinal glands* are absent and the structure of the *pedal glands* is constant, the floor of the depression slopes gradually downwards from the front of the fetlock to the heel-tie, where the integument is folded forwards and upwards to form a ridge constituting the distal well of the depression. The walls of the depression are covered with soft, short, silky hair. Elsewhere the hair of the foot is long and coarse, and it is noticeable that the space between the hoofs and the heel-tie itself are covered with long hair. In this character the feet of *Rupicapra* differ from those of other genera of Rupicaprines. Even in *Oreamnos,* where the greater part of the interdigital cleft is hairy, the heel-tie at least is naked *.

* My figure of the foot of the newly born chamois shows the point of the heel-tie to be naked. I am, unfortunately, unable to verify the accuracy of the drawing in that respect.

In 1910 I figured and described the *postcornual gland* of the male example then living in the Zoological Gardens when at their maximum of development, and a figure of the head of a female sketched on the same day was added to show the absence of the swelling. But in an adult female that died on Dec. 4th, 1912, I discovered the gland to be much better developed than would be expected from looking at the living animal, in which it is covered with the hair of the parietal region. The glandular area is superficially like that of the male, consisting of a subcircular area of skin marked with grooves. In section it is seen to be composed of thickened skin thrown from front to back into four folds, making ridges separated by valleys, the ridges gradually increasing in height from the base of the horn posteriorly.

It may be remembered that I described this gland in the adult female in 1910 as consisting of a crescentic groove behind the horn on each side, this description being taken from the historic preparation in the Museum of the Royal College of Surgeons. I have no doubt that this preparation was made from a female that died during the period of inactivity of the gland, and that the difference between this specimen and the one I examined, which died in December, is purely a question of seasonal development*.

The *rhinarium* (fig. 2, A, B) is small. It borders the nostril above as a narrow band, and it reaches inferiorly to the edge of the upper lip as a narrow vertically grooved philtrum ; but beneath the nostrils it only extends a short distance on each side of the middle line, the rest of the lower rim of the nostril being formed by hairy skin.

The extremity of the *penis* (fig. 2, F) is slightly depressed, and the urethral canal is prolonged beyond the extremity as a pointed process which is a little longer than that of *Nœmorhedus*, but shorter than that of *Budorcas* described below. But in the sketch published by Gerhardt in 1906 the process is at least as long as in *Budorcas*.

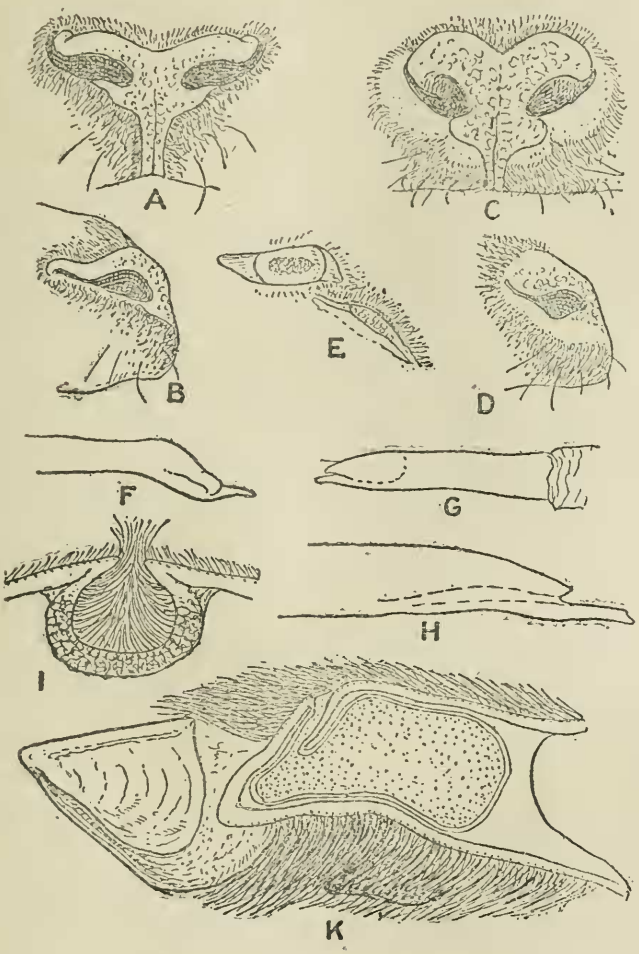
Genus Capricornis, Ogilb.

Capricornis sumatraensis jamrachi, Poc. (p. 855).

In 1910 I gave a brief account of the superficial appearance of the pedal and preorbital glands of an example of this

* It appears to me to be probable that the "postcornual sinus" described by Hodgson as present in *Procapra picticaudata* resembles in structure the postcornual gland of the female *Rupicapra* when it is in the stage of a crescentic groove. It is detectable in the newly born young of *Rupicapra* in this condition.

Fig. 2.



A. Rhinarium of *Rupicapra rupicapra* from the front, × ⅓.
B. The same from the side.
C. The same of *Næmorhedus goral* from the front, × ⅓.
D. The same from the side.
E. The eye and preorbital gland of *Næmorhedus goral*, the gland in section showing the thickened integument overgrown with hairs, holding secretion at their bases.
F. Extremity of penis of *Rupicapra rupicapra*.
G. The same of *Næmorhedus goral*.
H. The same of *Budorcas taxicolor*.
I. Section of preorbital gland of *Capricornis thar*.
K. Section of fore foot of the same, showing the large interdigital gland with its small orifice.

race, named *C. thar jamrachi*, which was then living in the Society's Gardens. The death of the animal in July 1913 enabled me to make a detailed examination of these glands.

The *preorbital gland* (fig. 2, I) consists of a comparatively deep, thick-walled, nearly spherical sack, the cavity of which is absolutely packed with long hairs, growing nearly vertically from its walls and protruding as a tuft from the small, circular, non-valvular orifice.

The *pedal glands* (fig. 2, K), alike on the front and hind legs, open by a small circular orifice on the front of the pastern at the summit of the interdigital cleft exactly as in *Ovis* and *Næmorhedus*, and, as in these genera, the orifice leads into a well-defined cylindrical tube or duct. But, whereas in *Ovis* and *Næmorhedus* this duct gradually passes into a comparatively small saccular portion of the gland bent upon the duct at an acute angle, in *Capricornis* the duct communicates abruptly with an immense saccular gland which occupies the entire space, bounded laterally by the bones of the feet and above and below by the anterior and posterior integument of the pastern. Inferiorly the sack reaches into the angle formed by the fold of integument constituting the heel-tie, and above it extends almost up to a point on a level with the upper edge of the false hoofs. The cavity of the sack was sparsely hairy and filled with brownish-yellow secretion.

So closely are the walls of the glandular sack applied to the integument of the pastern, that I am convinced the explanation of my failure to detect the gland in the dried skin of *C. argyrochætes*, mentioned on p. 855 of my previous paper, lies in the occurrence of a similar condition in that species. Hence the idea I then provisionally entertained, that possibly that species has no pedal glands, may be finally dismissed.

I am unable to find any justification for Lydekker's opinion that the various forms of *Capricornis* should be referred to two species, *C. sumatraensis*, comprising nine subspecies ranging from Kashmir to Sumatra and an unknown number from China, and *C. argyrochætes* from Kansu and Szechuan in China. The latter does not differ so much from some of the subspecies of *C. sumatraensis* as some of the latter differ from each other. In the present state of our knowledge it appears to me that the only courses open to us are to regard these forms as local races of one species, the course I adopted, or as so many distinct species—a course which I prefer to leave to him who has

the time and leisure to discover and define the characters to which specific rank may be assigned.

Genus Capricornulus, Heude.

Capricornulus crispus, Temm. (p. 855).

Heude separated this species of serow from *Capricornis* as a distinct genus *Capricornulus*, which Lydekker and I adopted as a subgenus. But it appears to me that the discovery of the structure of the pedal glands in *Capricornis* throws a different complexion on the question.

In 1910 I figured and described the pedal glands of *Capricornulus crispus*, and pointed out that they resemble in all respects those of *Næmorhedus*. Moreover, the discovery of the presence of preorbital glands in *Næmorhedus* (*cf. infra*) lessens the differences between that genus and *Capricornis*, and results in the occupation by *C. crispus* of a position intermediate between the two so far as cutaneous glands are concerned, the pedal glands resembling those of *Næmorhedus* and the preorbital glands those of *Capricornis*.

Genus Næmorhedus, H. Smith.

In 1910 my examination of material of this genus was limited to dried skins of *N. goral* and *N. raddeanus*. Since that date I have seen a fresh adult male example of the former species, which enables me to amplify and, in one particular, to correct my previous observations.

Næmorhedus goral, Hard. (p. 853).

A male example from Chamba, presented by Major Rodon in 1904, which died Nov. 4th, 1915.

The *preorbital gland* was declared to be absent in this genus by Owen, Hodgson, and Ogilby. That statement, which I accepted, proves to be untrue, strictly speaking, although the gland is so small as to account for its being overlooked on dried skins or even on fresh material. Externally the gland is marked by a very small patch of nearly naked skin covered with dry scurf-like secretion. There is no invagination of the integument, but beneath the patch of bare epidermis, the dermis is thickened and glandular (fig. 2, E). The gland, although relatively smaller, may be compared in its development to that of

Adenota kob or *Hippotragus niger*; but whether it represents a rudimentary or vestigial condition of the pouch-like preorbital gland of *Capricornis* must be left an open question.

The *pedal glands* and the structure of the feet resemble in every respect those of *N. raddeanus*, described and figured on p. 854 of my previous paper. *Inguinal glands*, as noticed in 1910, are absent.

The *rhinarium* (fig. 2, C, D) is large and naked on its upper surface almost as far back as the posterior angle of the nostril, but in the middle line above, the hair grows forwards, forming an angular point. Beneath the nostril laterally there is a comparatively wide area of smooth naked skin. In front the rhinarium extends to the edge of the upper lip as a narrow grooved strip of corrugated integument which expands above to right and left beneath the inner angle of the nostrils, and the expanded portion is flanked on each side by an area of smooth naked skin.

The *penis* (fig. 2, G) is cylindrical, slightly expanded distally, then gradually narrowed to the apex, beyond which the end of the urethral canal is prolonged as a tube for a short distance.

Two points of special interest may be noticed in connection with these observations: namely, the similarity of the penis to that of *Budorcas*, described below, and the presence of the preorbital gland, which serves to link *Næmorhedus* closer with *Capricornis* than was previously supposed to be the case.

Genus Budorcas, Hodgson.

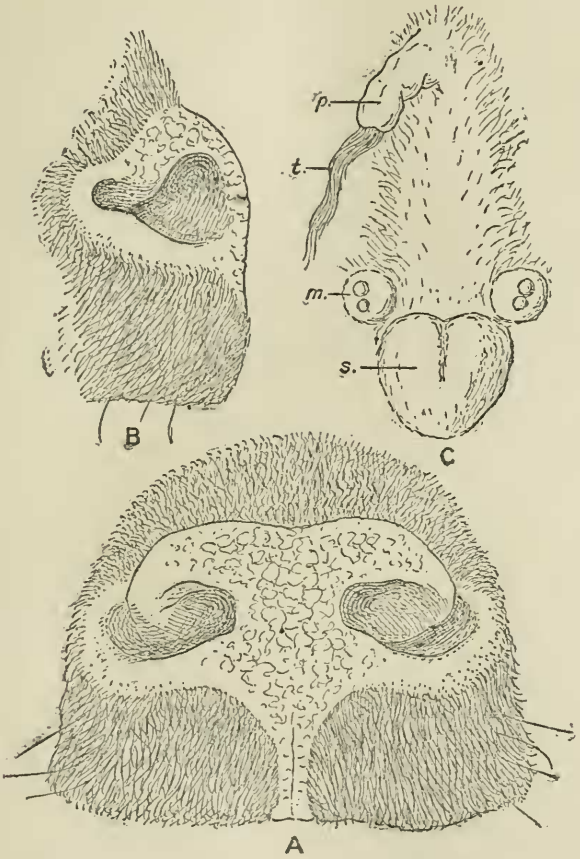
Budorcas taxicolor, Hodgson (p. 856).

The death of a male example of this species from N.W. Bhotan enables me to verify and extend my account of the external characters of this genus published in 1910, and based partly on this example when alive and partly upon a dried skin of *B. taxicolor tibetanus* lent to me by Mr. Gerrard.

The *rhinarium* (fig. 3, A, B) is continued inferiorly to the edge of the upper lip as a narrow mesially grooved strip, which is longer than in *Næmorhedus* owing to the greater depth of the upper lip. Laterally an area of naked skin, narrower than in *Næmorhedus*, is continued with a bold curve beneath the widely expanded nostrils, and curving round their posterior extremities passes into the dorsal

portion of the rhinarium, which is much shorter from before backwards than in *Næmorhedus*, being considerably more overgrown with hair.

Fig. 3.



A. Muzzle of *Budorcas taxicolor* from the front, × ½.
B. The same from the side.
C. Genital area of *Budorcas taxicolor*. *p.*, pendulous extremity of penis; *t.*, long tuft of hair protruding from the prepuce; *m.*, mammæ arising from glandular elevation; *s.*, scrotum.

The *feet* resemble in essential particulars those of the dried example figured in 1910 (p. 852) and described (p. 856), except that on the fore foot there is no trace of the

transverse ridge of integument just where the hair of the pastern ceases in the interungual space. There is no trace of definite pedal gland, although the hair at the bottom of the interdigital depression in front is stuck together with secretion, indicating activity of the skin at that spot. The hind foot is like the front foot.

There is no trace of *preorbital gland* or of *inguinal glands* in the ordinary sense of that term ; but the two mammæ (fig. 3, C, *m.*) on each side, set as far out from the middle line as the outer edge of the scrotum, are close together, one in front of the other, in the centre of a distinct swelling like a small udder. When the skin is cut away, this swelling is seen to be caused by a blackish glandular mass like a small bunch of grapes, and blackish secretion could be squeezed through a single pore on the posterior teat with the use of considerable pressure. This unusual condition of the mammary gland in the male is worth putting on record, although, pending the examination of other specimens of *Budorcas*, it must be regarded, I think, as pathological in one individual.

The *penis* (fig. 3, C, *p.*) is provided with a pendulous prepuce, three inches long, rising from the abdomen six inches in front of the scrotum. Just within the orifice of the prepuce the skin is highly glandular and overgrown with long hairs, which protrude from the aperture to form a tuft three or four inches long. The *glans penis* (fig. 2, H) is apically attenuated and provided with a straight, moderately stout, urethral prolongation projecting some little way beyond the tip of the glans. Except for the greater elongation of the free portion of the urethral canal, the glans penis is very like that of *Næmorhedus*.

One of the chief interests connected with *Budorcas* is involved in the claim that the genus is related to *Ovibos*, whose uncertain position in the Bovidæ was expressed by Lönnberg's ascription of it to a special subfamily Ovibovinæ (Proc. Zool. Soc. 1900, pp. 142–167). Judging from the characters dealt with in this paper it does not appear to me that the claim of close relationship between the two forms can be maintained, and I am disposed to regard the resemblances between them in horn-growth, robustness of build, etc., as independently acquired. The differences between them may be tabulated as follows. For most of the characters relating to *Ovibos* I am indebted to Lönnberg's paper :—

Budorcas, ad. ♂.

Rhinarium well developed, about 14 mm. deep above the nostrils, 26 mm. wide between them, and extended beneath them as a naked strip of skin and passing inferiorly to the edge of the upper lip as a mesially grooved band (*philtrum*) about 7 mm. wide.

Preorbital gland absent.

Hoofs narrower, more pointed in front, integument between them naked.

Mammæ 4, the anterior and posterior on each side almost in contact, but very widely separated from those of the opposite side, the four together arranged in a transverse oblong about five times as wide as long.

Prepuce distally pendulous, distal portion of its cavity not provided with longitudinal ridges, but thickly beset with coarse long hairs protruding at all seasons some 4 inches from the orifice as a long tuft.

Glans penis markedly attenuated at the apex, the urethral canal prolonged for a considerable distance beyond the tip.

Ovibos, ad. ♂.

Rhinarium greatly reduced, about 8 mm. deep above the nostrils and only a little more between them, not extending beneath them and not continued inferiorly to the edge of the upper lip.

Preobital gland present, invaginated.

Hoofs broad, wide in front, integument between them thickly hairy except for the naked heel-tie.

Mammæ 4, arranged so as to form the normal four-sided figure, which is only a little wider than long, the anterior being separated from the posterior on each side by a considerable space.

Prepuce distally pendulous, distal portion of its cavity provided with longitudinal folds and clothed with fine hairs only in the winter, but these do not form a long protruding tuft.

Glans penis blunt at the end, the urethral canal not extending beyond its tip.

But although the differences above tabulated exclude the idea of relationship between *Budorcas* and *Ovibos*, sufficiently intimate to warrant the removal of *Budorcas* from the Rupicaprinæ, as now understood, and its association with *Ovibos* in a special subfamily, they by no means justify the conviction that *Ovibos* is not a specialised Rupicaprine. The description, for example, of the preorbital gland applies to that of *Capricornis* or *Capricornulus*, and the termination of the urethral canal in *Nœmorhedus* is nearly intermediate in development between those of *Budorcas* and *Ovibos*; the arrangement of the mammæ is normal for the Ruminantia, as a whole, including the typical Rupicaprines; the structure of the feet may be easily derived in imagination from that of *Oreamnos* or even of *Nœmorhedus*, in which the gland has reached the retort-like stage, which in the Caprinæ precedes its total suppression, as attested by *Ovis* and *Capra*, and the reduction of the rhinarium in *Ovibos* is foreshadowed

in *Rupicapra*, except for the total suppression of the *philtrum*. In this respect *Ovibos* is highly specialised and unique, so far as its possible allies are concerned.

On the evidence before me, I consider that if the Ovibovinæ be maintained as a special subfamily of Bovidæ, the Rupicaprinæ, as at present understood, should be split up into three subfamilies, the Rupicaprinæ for *Rupicapra* and *Oreamnos*, the Næmorhedinæ for *Næmorhedus*, *Capricornulus*, and *Capricornis*, and the Budorcinæ for *Budorcas*. But if the conservative course of maintaining the Rupicaprinæ in its recognised comprehensive sense be followed, then *Ovibos* should, I think, be one of the genera of this somewhat heterogeneous assemblage.

Subfamily *Caprinæ*.

Genus Ovis, Linn.

Ovis musimon, Schr., and *O. vignei*, Blyth (pp. 859–861).

Since 1910 I have examined representatives of the two species previously recorded, namely *Ovis vignei* and *O. musimon*, without finding anything to add or alterations to make to my previous description of the cutaneous glands, except to remark that in the case of *O. musimon* the naked condition of the interungual integument noticed in one specimen is quite exceptional, and that as a very general rule that species and *O. vignei* are alike with respect to the hairiness of the area in question. Possibly the variation noticed is seasonal, as appears to be the case in *Ammotragus lervia*.

The *rhinarium* of *O. vignei* is quite characteristic of the genus. It extends as a narrow bar above the nostrils almost back to their posterior termination, the internarial septum is narrow, the area beneath the septum is a little expanded, and a narrow *philtrum* cleaves the upper lip, but there is no naked area of skin bordering the nostrils below.

The *penis* of *O. vignei* (fig. 4, D), as in *O. aries*, ends in a blunt gland-like enlargement, bent downwards distally. From its underside the very long filiform termination of the urethral canal arises, and passes forward on the left side of the glandular thickening.

Genus Pseudois, Hodgson.

Pseudois nayaur, Hodgs. (p. 863).

Specimens examined since 1910 confirm in every respect

the constancy of the characters upon which I separated this species from *Ovis*—namely, the suppression of the preorbital, inguinal, and pedal glands.

The *rhinarium* (fig. 4, F, G) resembles in a general way that of *Ovis vignei*, but the nostrils are more dilatable and the "philtrum" less well defined, hardly a trace of it remaining. In one specimen the hairs of the upper lip are only separated by a very narrow parting, which is completely overlapped and concealed by the hairs to the right and left of it.

The naked underside of the tail (fig. 4, H) is marked on each side above the anus with a wide and moderately deep *glandular depression*, corresponding with the subcaudal gland of *Capra*, but smaller.

The glandular portion of the end of the *penis* (fig. 4, B) is longer and straighter than in *Ovis vignei*, but the filiform termination of the urethra is approximately as long as in that species, and much longer than in the following genera. The length of this tube and the absence of strong "Caprine" smell in the male are two points in which *Pseudois* comes nearer *Ovis* than *Capra*. In the suppression of the specialised cutaneous glands *Pseudois* is Caprine and not Ovine.

Genus Ammotragus, Blyth.

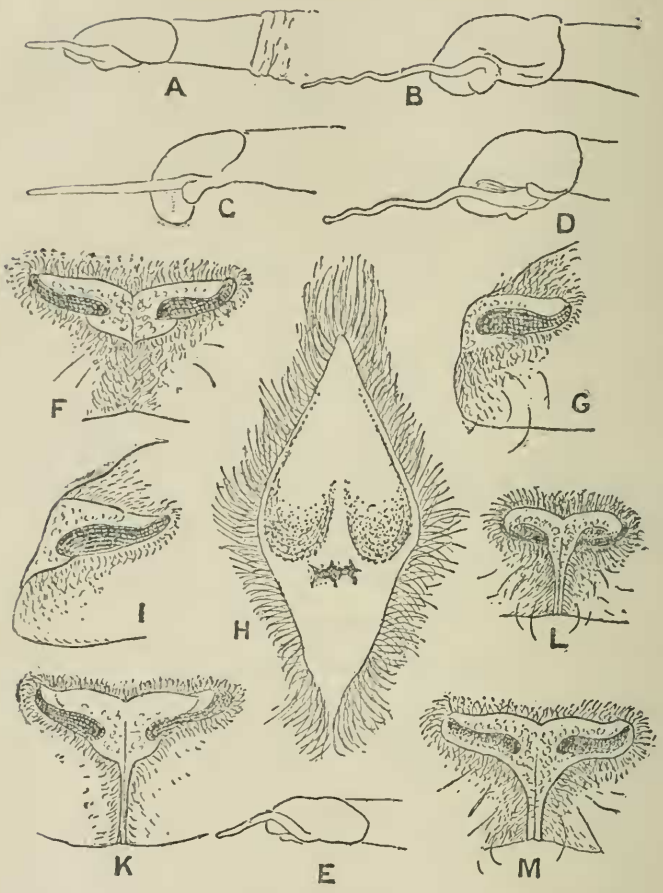
Ammotragus lervia, Pall. (p. 862).

My notes upon this species, published in 1910, were taken from the examination of a living specimen. Several dead examples that have passed through my hands since that date confirm in every respect the statement then made as to the absence of the preorbital, inguinal, and pedal glands.

A peculiarity I drew attention to in 1910—namely, the smoothness of the interdigital depression in the example examined—proves to be inconstant, although the hairs of this area when developed are not so long as in *Ovis* and *Pseudois*. Possibly the variation is seasonal. For instance, in a specimen (♂) that died on Nov. 11th, the interdigital cleft was clothed with short hairs down to the heel-tie, as is normal in the Caprine series. In a second that died on March 5th, the interdigital cleft was naked. A third, which died on Feb. 10th, exhibited a condition intermediate between those of the other two. In the newly born young the space is covered with hair.

The *rhinarium* (fig. 4, M) presents no features of special

Fig. 4.



A. Extremity of penis of *Hemitragus jemlaicus*.
B. The same of *Pseudois nayaur*.
C. The same of *Ammotragus lervia*.
D. The same of *Ovis vignei*.
E. The same of *Capra ægagrus*.
F. Rhinarium of *Pseudois nayaur*, showing absence of philtrum, × $\frac{1}{3}$.
G. The same from the side.
H. Lower side of base of tail of *Pseudois nayaur*, showing the pair of glandular depressions above the anus.
I. Rhinarium of *Hemitragus jemlaicus* from the side, × $\frac{1}{3}$.
K. The same from the front.
L. The same of *Capra ægagrus*, × $\frac{1}{3}$.
M. The same of *Ammotragus lervia*, × $\frac{1}{3}$.

interest, being typically Ovine or Caprine in structure, with the narrow "philtrum" well developed.

There is a well-marked *subcaudal gland* above the anus as in *Pseudois*.

The gland-like termination of the *penis* (fig. 4, C) is very like that of *Ovis vignei* in shape and curvature, but the filiform termination of the urethra is a little shorter than in that species.

According to Lydekker, the males of this animal are not malodorous (Cat. Ungulates, i. p. 123). That is quite untrue. The males have a very decidedly goaty odour in the breeding season. It is also untrue that the typical race of this species is distinguished by "an indistinct median face stripe." A pair imported from Morocco and exhibited in the Gardens a few years ago showed no trace of such a stripe.

Genus Capra, Linn. (p. 864).

I have nothing to add to what I said in 1910 regarding the suppression of the preorbital, pedal, and inguinal glands in various species of this genus.

The *rhinarium* conforms in type to that of *Ovis* and *Ammotragus*, the "philtrum" being better defined than in *Pseudois*. In an example of *C. ægagrus* from Crete, I found the supranarial extension of the rhinarium (fig. 4, L) larger than in most examples of domesticated goats; but this varies to a certain degree in the latter, as also does the width of the naked area of skin beneath the nostrils laterally

The *subcaudal gland* was a deeper pocket than those observed in *Ammotragus* and *Pseudois*.

The *penis* (fig. 4, E) also is constructed very much as in those genera, and has a well-defined, but rather short, glandular termination, which, on the right side, as in the other genera, curls beneath the tubular filiform termination of the urethra, which is shorter than in *Ovis*, *Ammotragus*, and *Pseudois*.

Genus Hemitragus, Hodgson.

Hemitragus jemlaicus, Hodgs. (p. 866).

Additional specimens confirm my previous statements with regard to the suppression of the preorbital, inguinal, and pedal glands.

Hodgson's assertion that the *rhinarium* (fig. 4, I, K) is larger in *Hemitragus* than in *Capra* is perfectly true. The supranarial extension is considerably deeper, and, similarly,

the extension beneath the inner angles of the nostrils in front is wider.

In the *penis* (fig. 4, A) the glandular termination is more elongate and less bulbous than in *Capra* and the filiform termination of the urethra is shorter. It is the shortest, indeed, that is found within the limits of the Caprinæ.

The *subcaudal gland* is represented externally by a shallow depression above and at the sides of the anus.

Note on the Penis of the Cephalophinæ *and* Neotraginæ.

In my paper published in the issue of this Journal for June 1918, I regret that I overlooked at the time Lönnberg's descriptions and figures of the penis of *Cephalophus natalensis* and of *Sylvicapra grimmia* (Ark. Zool. Stockholm, (5) v. no. 10, pp. 2–3, figs. 1–2, 1909). He shows that in *C. natalensis* the urethral canal has a very long filiform prolongation resembling that of *Guevei maxwelli* figured by Garrod (P. Z. S. 1877, p. 10, fig. 20), whereas in *S. grimmia* the tubular prolongation is quite short, only overlapping the glans to a small extent. Now, *C. natalensis* is so closely related to *C. dorsalis* as hardly to admit of a doubt as to identity in the structure of the penis in the two species. In that case the penis of *C. dorsalis* I described as being without the tubular urethral prolongation must have been defective, owing to mutilation. Lönnberg's observations show that *Cephalophus* differs from *Sylvicapra* not by the suppression of the urethral prolongation, as I stated, but by its development and length, which affiliate the former genus with *Guevei*.

In the case of the Neotraginæ, it may be recalled that Garrod (*op. cit.* p. 11, fig. 21) described the penis of *Ourebia nigricaudata* as possessing a long slender urethral prolongation considerably overlapping the slender tip of the glans penis, whereas, according to Lönnberg's observations (*op. cit.* p. 4, figs. 3–4), the urethra does not surpass the tip of the glans in *Raphicerus campestris* and *Neotragus livingstonianus*. The penis of the example of *Nototragus melanotis* in which I found the preputial gland agrees with that of *Raphicerus campestris*.